

PATENT ABSTRACTS OF JAPAN

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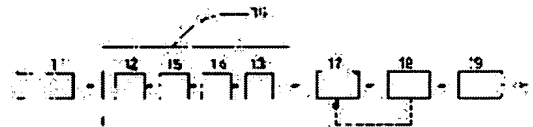
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MIYASHITA MASAYASU

(54) CAMERA SYSTEM

(57)Abstract:

PURPOSE: To attain lower prices and miniaturization by reducing the number of circuits for analog signal processing.

CONSTITUTION: The voltage amplitude of the output signal of an analog signal processing circuit 16 which performs the analog processing of the output signal of a solid-state image pickup element 11 is detected by a digital signal processing circuit 18 which processes the output signal of an A/D converter 17 to convert the output signal of the solid-state image pickup element 11 into a digital signal, and the upper side reference voltage for A/D conversion and the lower side reference voltage for A/D conversion of the A/D converter 17 are varied so as to be proportional to the voltage amplitude of the output signal of the solid-state image pickup element 11 based on a detection result. Since the reference voltage of A/D conversion is varied fitting in the level of a signal inputted to the A/D converter 17, no gain control by analog signal processing before the A/D conversion is required, which simplifies the circuit.



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CLAIMS

[Claim(s)]

[Claim 1]A camera system comprising:

A solid state image pickup device.

An A/D converter which changes into a digital signal an analog signal outputted from this solid state image pickup device.

An A/D conversion reference voltage control circuit which controls upper part reference voltage for A/D conversions of said A/D converter according to a voltage level of an analog signal outputted from said solid state image pickup device.

[Claim 2]The camera system according to claim 1 with which an A/D conversion reference voltage control circuit controlled bottom reference voltage for A/D conversions of an A/D converter according to a voltage level of an analog signal outputted from a solid state image pickup device.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the camera system using digital signal processing (A/D converter), such as a video camera.

[0002]

[Description of the Prior Art]In recent years, the chief aim of development is put on the place where the video camera and the camera for surveillance were called small size, a light weight, high efficiency, and low price.

Digitization of signal processing is progressing.

First, the composition of the conventional digital-signal-processing video camera carrying an A/D converter is shown in drawing 3. This video camera The solid state image pickup device (CCD) 1 and a KORIRETIDDO double sampling. (It abbreviates to CDS hereafter) The analog signal processing circuit 7 including the circuit 2, the automatic gain control (it abbreviates to AGC hereafter) circuit 3, the gamma correction process circuit 4, the blanking processing circuit 5, and the clamping process circuit 6, It comprises A/D converter 8, the digital signal processing circuit (DSP) 9, and D/A converter 10.

[0003]The voltage waveform figure of each part of the video camera of drawing 3 is shown in drawing 4. In the voltage waveform figure of drawing 4, take voltage to a lengthwise direction and time is taken in the transverse direction, The A/D conversion signal with which (a) pretreated the Vertical Synchronizing signal, (b) pretreated upper part reference voltage V_{REFH} for A/D conversions, and (c) pretreated the output of the solid state image pickup devices 1, such as CDS, AGC, blanking processing, and a gamma correction process, and (d) show bottom reference voltage V_{REFL} for A/D conversions.

[0004]The output signal of the solid state image pickup device 1 is an analog signal, and before carrying out digital signal processing, it is necessary to carry out the A/D conversion of it. Upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are inputted into A/D converter 8, respectively, The input signal level for [which is inputted into A/D converter 8] conversion is determined so that the range of both reference voltage V_{REFH} and V_{REFL} may be suited. In this case, signal amplitude is adjusted in AGC circuit (analog) 3 so that the input signal level of A/D converter 8 may be suited. A/D converter 8 divides between two reference voltage of upper part reference voltage V_{REFH} for A/D conversions, and bottom reference voltage V_{REFL} for A/D conversions into plurality, and an A/D conversion is carried out by comparing each division voltage with an input signal.

[0005]Before carrying out an A/D conversion, the portion which analog signal processing can realize more efficiently compared with digital signal processing, such as noise rejection peculiar to the solid state image pickup device 1 and a gamma correction process for black level reproduction and television outputs, is performed by analog signal processing. Thus, after performing required analog signal processing to the output signal of the solid state image pickup device 1, high efficiency and multi-functionalization of the video camera are advanced as

composition which carries out an A/D conversion and performs digital signal processing in the digital signal processing circuit 9.

[0006]

[Problem(s) to be Solved by the Invention]However, in the above composition, there are many analog signal processing circuits and they cannot realize low-pricing and a miniaturization. This invention solves an aforementioned problem, and an analog signal processing circuit is lessened, the price fall, and it aims at providing the camera system which can realize a miniaturization.

[0007]

[Means for Solving the Problem]An A/D converter from which the camera system according to claim 1 changes into a digital signal an analog signal outputted from a solid state image pickup device and this solid state image pickup device, It has an A/D conversion reference voltage control circuit which controls upper part reference voltage for A/D conversions of said A/D converter according to a voltage level of an analog signal outputted from said solid state image pickup device.

[0008]He is trying for an A/D conversion reference voltage control circuit to control the camera system according to claim 2 in the camera system according to claim 1 according to a voltage level of an analog signal outputted from a solid state image pickup device in bottom reference voltage for A/D conversions of an A/D converter.

[0009]

[Function]By changing the upper part reference voltage for A/D conversions of an A/D converter, and the bottom reference voltage for A/D conversions according to the analog signal voltage outputted from a solid state image pickup device according to the composition of this invention. An A/D converter can realize an AGC function and the AGC circuit of the analog signal processing which was required for the conventional camera system can be omitted.

[0010]

[Example]Hereafter, the camera system of one example of this invention is explained. Drawing 1 shows one example of this invention, and shows the composition of the digital-signal-processing type video camera carrying an A/D converter. The analog signal processing circuit 16 where this video camera includes the solid state image pickup device 11, CDS circuit 12 and the gamma correction process circuit 13, the blanking processing circuit 14, and the clamping process circuit 15, It comprises A/D converter 17, the digital signal processing circuit (DSP) 18, and D/A converter 19.

[0011]The voltage waveform figure of each part of the video camera of drawing 1 is shown in drawing 2. In the voltage waveform figure of drawing 2, take voltage to a lengthwise direction and time is taken in the transverse direction, The A/D conversion signal with which (a) pretreated the Vertical Synchronizing signal, (b) pretreated upper part reference voltage V_{REFH} for A/D conversions, and (c) pretreated the output of the solid state image pickup devices 1, such as CDS, AGC, blanking processing, and a gamma correction process, and (d) show bottom reference voltage V_{REFL} for A/D conversions.

[0012]The output signal of the solid state image pickup device 11 is an analog signal, and before carrying out digital signal processing, it is necessary to carry out the A/D conversion of it. Upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are inputted into A/D converter 17, respectively, The input signal level for [which is inputted into A/D converter 17] conversion is determined so that the range of both reference voltage V_{REFH} and V_{REFL} may be suited. In this case, A/D converter 17 divides between two reference voltage of upper part reference voltage V_{REFH} for A/D conversions, and bottom reference voltage V_{REFL} for A/D conversions into plurality, By comparing each division voltage with an input signal, an A/D conversion is performed and a conversion output signal is inputted into the digital signal processing circuit 18.

[0013]this time -- digital signal processing (Y -- it and) with the arbitrary digital signal processing circuit 18 [C-signal-] While detecting the peak value of the signal amplitude in the inside of those for the 1 field of an A/D conversion signal else [, such as synchronization of C

signal, and automatic white balance adjustment,], A minimum level value is detected, and based on a peak value and a minimum level value, as shown in (b) of drawing 2, and (d), upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are changed to the state of being proportional to the amplitude of the signal level of an analog signal. Since upper part reference voltage V_{REFH} for A/D conversions of A/D converter 17 and bottom reference voltage V_{REFL} for A/D conversions change by this according to the level of a signal inputted into A/D converter 17, It becomes unnecessary to carry out a gain adjustment by analog signal processing before an A/D conversion, and the AGC circuit which was necessity conventionally can be omitted.

[0014]In this case, upper part reference voltage V_{REFH} for A/D conversions is set up be proportional to the peak value of the signal level for every field of an A/D conversion signal so that clearly from drawing 2, Bottom reference voltage V_{REFL} for A/D conversions is set up be proportional to the minimum level value of the signal level for every field of an A/D conversion signal. In drawing 2, it is because there is no change in the peak value of a signal level in the two fields that upper part reference voltage V_{REFH} for A/D conversions is the same value over the 2 fields. Although the minimum level value change of a signal level becomes [in CDS circuit 12] fixed fundamentally in the after-removal clamping process circuit 15, Depending on setting out (a damping time constant is shortened) of a clamp constant, it generated with dispersion in alumnus (optical black) level of the solid state image pickup device (CCD) 11, and dispersion in this OB level is compensated by changing bottom reference voltage V_{REFL} for A/D conversions.

[0015]Upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are set up according to the peak value and minimum level value of a signal level in front of 1 field. When picturizing with a video camera, an image actually changes hardly for every field like drawing 2. A problem is not produced even if it sets up upper part reference voltage V_{REFH} for A/D conversions, and bottom reference voltage V_{REFL} for A/D conversions based on the data of the peak value in front of 1 field. Even if an image has a big change, in order to converge in the 1 field, it does not become a screen top problem.

[0016]As an example of composition of controlling upper part reference voltage V_{REFH} for A/D conversions of A/D converter 17 and bottom reference voltage V_{REFL} for A/D conversions by the output of the digital signal processing circuit 18, The data for AGC is created apart from [digital signal processing circuit / 18] a video signal, D/A conversion of this data is carried out in the digital signal processing circuit 18, analog voltage is outputted, and it is possible to supply A/D converter 17. The D/A converter which could carry out with integrated circuit with the another digital signal processing circuit 18, and was built in A/D converter 17 may perform D/A conversion.

[0017]Although ** field reference voltage is changed like drawing 2, this example is available depending on the method of detection, even if later [, and]. For example, the range about the number field can be considered from about several lines. When picturizing what has a uniform signal level of the whole screen as the method of detection with the video camera used for factory automation (FA) etc., for example, there is what (it carries out early) the signal of several lines of the upper part of a screen is detected for. Since the screen is uniform at this time, several lines are enough as detection. Since the number field is considered about making it late, it is ordinarily carried out on making a video camera.

[0018]Although feedback control of the value of the reference voltage of A/D converter 17 is carried out from the digital signal processing circuit 18 like drawing 1 in this example, When the peak detector of a signal level is formed in the analog signal processing circuit 16, the value of the reference voltage of A/D converter 17 may be controlled from other circuits of analog signal processing circuit 16 grade. In order to control the value of the reference voltage of A/D converter 17, constituted from an above-mentioned example so that the peak value of the signal level of the output of A/D converter 17 might be detected in the digital signal processing circuit

18, but. Not only this but the thing for which the average value of the maximum of a signal level and a minimum is taken, respectively, for example, and reference voltage (for example, about 3 times of a detection value) is opted with a bigger margin than the time of peak detection is considered.

[0019] In the above-mentioned example, although bottom reference voltage V_{REFL} for A/D conversions of A/D converter 8 was variable, it may be immobilization. That is, if it is only an AGC function, it is enough just to change upper part reference voltage V_{REFH} for A/D conversions, but. In the above-mentioned example, in order to raise the accuracy of AGC, bottom reference voltage V_{REFL} for A/D conversions is also changed, and compensation over dispersion in an optical black level is performed.

[0020]

[Effect of the Invention] Since the upper part reference voltage for A/D conversions of an A/D converter and the bottom reference voltage for A/D conversions were changed into the state of being proportional to the amplitude of analog signal voltage, in the camera system of this invention, An A/D converter can realize an AGC function, the AGC circuit of the analog signal processing which was required for the conventional camera system can be omitted, and miniaturization and low-pricing can be attained. Therefore, the practical effect is size very much.

[Translation done.]

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TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art]In recent years, the chief aim of development is put on the place where the video camera and the camera for surveillance were called small size, a light weight, high efficiency, and low price.

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First, the composition of the conventional digital-signal-processing video camera carrying an A/D converter is shown in drawing 3. This video camera The solid state image pickup device (CCD) 1 and a KORIRETIDDO double sampling. (It abbreviates to CDS hereafter) The analog signal processing circuit 7 including the circuit 2, the automatic gain control (it abbreviates to AGC hereafter) circuit 3, the gamma correction process circuit 4, the blanking processing circuit 5, and the clamping process circuit 6, It comprises A/D converter 8, the digital signal processing circuit (DSP) 9, and D/A converter 10.

[0003]The voltage waveform figure of each part of the video camera of drawing 3 is shown in drawing 4. In the voltage waveform figure of drawing 4, take voltage to a lengthwise direction and time is taken in the transverse direction, The A/D conversion signal with which (a) pretreated the Vertical Synchronizing signal, (b) pretreated upper part reference voltage V_{REFH} for A/D conversions, and (c) pretreated the output of the solid state image pickup devices 1, such as CDS, AGC, blanking processing, and a gamma correction process, and (d) show bottom reference voltage V_{REFL} for A/D conversions.

[0004]The output signal of the solid state image pickup device 1 is an analog signal, and before carrying out digital signal processing, it is necessary to carry out the A/D conversion of it. Upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are inputted into A/D converter 8, respectively, The input signal level for [which is inputted into A/D converter 8] conversion is determined so that the range of both reference voltage V_{REFH} and V_{REFL} may be suited. In this case, signal amplitude is adjusted in AGC circuit (analog) 3 so that the input signal level of A/D converter 8 may be suited. A/D converter 8 divides between two reference voltage of upper part reference voltage V_{REFH} for A/D conversions, and bottom reference voltage V_{REFL} for A/D conversions into plurality, and an A/D conversion is carried out by comparing each division voltage with an input signal.

[0005]Before carrying out an A/D conversion, the portion which analog signal processing can realize more efficiently compared with digital signal processing, such as noise rejection peculiar to the solid state image pickup device 1 and a gamma correction process for black level reproduction and television outputs, is performed by analog signal processing. Thus, after performing required analog signal processing to the output signal of the solid state image pickup device 1, high efficiency and multi-functionalization of the video camera are advanced as composition which carries out an A/D conversion and performs digital signal processing in the digital signal processing circuit 9.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, in the above composition, there are many analog signal processing circuits and they cannot realize low-pricing and a miniaturization. This invention solves an aforementioned problem, and an analog signal processing circuit is lessened, the price fall, and it aims at providing the camera system which can realize a miniaturization.

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MEANS

[Means for Solving the Problem]An A/D converter from which the camera system according to claim 1 changes into a digital signal an analog signal outputted from a solid state image pickup device and this solid state image pickup device, It has an A/D conversion reference voltage control circuit which controls upper part reference voltage for A/D conversions of said A/D converter according to a voltage level of an analog signal outputted from said solid state image pickup device.

[0008]He is trying for an A/D conversion reference voltage control circuit to control the camera system according to claim 2 in the camera system according to claim 1 according to a voltage level of an analog signal outputted from a solid state image pickup device in bottom reference voltage for A/D conversions of an A/D converter.

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OPERATION

[Function]By changing the upper part reference voltage for A/D conversions of an A/D converter, and the bottom reference voltage for A/D conversions according to the analog signal voltage outputted from a solid state image pickup device according to the composition of this invention. An A/D converter can realize an AGC function and the AGC circuit of the analog signal processing which was required for the conventional camera system can be omitted.

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EXAMPLE

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[0012]The output signal of the solid state image pickup device 11 is an analog signal, and before carrying out digital signal processing, it is necessary to carry out the A/D conversion of it. Upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are inputted into A/D converter 17, respectively, The input signal level for [which is inputted into A/D converter 17] conversion is determined so that the range of both reference voltage V_{REFH} and V_{REFL} may be suited. In this case, A/D converter 17 divides between two reference voltage of upper part reference voltage V_{REFH} for A/D conversions, and bottom reference voltage V_{REFL} for A/D conversions into plurality, By comparing each division voltage with an input signal, an A/D conversion is performed and a conversion output signal is inputted into the digital signal processing circuit 18.

[0013]this time -- digital signal processing (Y -- it and) with the arbitrary digital signal processing circuit 18 [C-signal-] While detecting the peak value of the signal amplitude in the inside of those for the 1 field of an A/D conversion signal else [, such as synchronization of C signal, and automatic white balance adjustment,], A minimum level value is detected, and based on a peak value and a minimum level value, as shown in (b) of drawing 2, and (d), upper part reference voltage V_{REFH} for A/D conversions and bottom reference voltage V_{REFL} for A/D conversions are changed to the state of being proportional to the amplitude of the signal level of an analog signal. Since upper part reference voltage V_{REFH} for A/D conversions of A/D converter 17 and bottom reference voltage V_{REFL} for A/D conversions change by this according to the level of a signal inputted into A/D converter 17, It becomes unnecessary to carry out a gain adjustment by analog signal processing before an A/D conversion, and the AGC circuit which was necessity conventionally can be omitted.

[0014]In this case, upper part reference voltage V_{REFH} for A/D conversions is set up be proportional to the peak value of the signal level for every field of an A/D conversion signal so

that clearly from drawing 2, Bottom reference voltage V_{REFL} for A/D conversions is set up be proportional to the minimum level value of the signal level for every field of an A/D conversion signal. In drawing 2, it is because there is no change in the peak value of a signal level in the two fields that upper part reference voltage V_{REFH} for A/D conversions is the same value over the 2 fields. Although the minimum level value change of a signal level becomes [in CDS circuit 12] fixed fundamentally in the after-removal clamping process circuit 15, Depending on setting out (a damping time constant is shortened) of a clamp constant, it generated with dispersion in alumnus (optical black) level of the solid state image pickup device (CCD) 11, and dispersion in this OB level is compensated by changing bottom reference voltage V_{REFL} for A/D conversions.

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[0016]As an example of composition of controlling upper part reference voltage V_{REFH} for A/D conversions of A/D converter 17 and bottom reference voltage V_{REFL} for A/D conversions by the output of the digital signal processing circuit 18, The data for AGC is created apart from [digital signal processing circuit / 18] a video signal, D/A conversion of this data is carried out in the digital signal processing circuit 18, analog voltage is outputted, and it is possible to supply A/D converter 17. The D/A converter which could carry out with integrated circuit with the another digital signal processing circuit 18, and was built in A/D converter 17 may perform D/A conversion.

[0017]Although ** field reference voltage is changed like drawing 2, this example is available depending on the method of detection, even if later [, and]. For example, the range about the number field can be considered from about several lines. When picturizing what has a uniform signal level of the whole screen as the method of detection with the video camera used for factory automation (FA) etc., for example, there is what (it carries out early) the signal of several lines of the upper part of a screen is detected for. Since the screen is uniform at this time, several lines are enough as detection. Since the number field is considered about making it late, it is ordinarily carried out on making a video camera.

[0018]Although feedback control of the value of the reference voltage of A/D converter 17 is carried out from the digital signal processing circuit 18 like drawing 1 in this example, When the peak detector of a signal level is formed in the analog signal processing circuit 16, the value of the reference voltage of A/D converter 17 may be controlled from other circuits of analog signal processing circuit 16 grade. In order to control the value of the reference voltage of A/D converter 17, constituted from an above-mentioned example so that the peak value of the signal level of the output of A/D converter 17 might be detected in the digital signal processing circuit 18, but. Not only this but the thing for which the average value of the maximum of a signal level and a minimum is taken, respectively, for example, and reference voltage (for example, about 3 times of a detection value) is opted with a bigger margin than the time of peak detection is considered.

[0019]In the above-mentioned example, although bottom reference voltage V_{REFL} for A/D conversions of A/D converter 8 was variable, it may be immobilization. That is, if it is only an AGC function, it is enough just to change upper part reference voltage V_{REFH} for A/D conversions, but. In the above-mentioned example, in order to raise the accuracy of AGC, bottom reference voltage V_{REFL} for A/D conversions is also changed, and compensation over dispersion in an optical black level is performed.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a block diagram showing the composition of the video camera of one example of this invention.

[Drawing 2]It is a voltage waveform figure of each part of the video camera of drawing 1.

[Drawing 3]It is a block diagram showing the composition of an example of the conventional video camera.

[Drawing 4]It is a voltage waveform figure of each part of the video camera of drawing 3.

[Description of Notations]

11 Solid state image pickup device

12 CDS circuit

13 Gamma correction process circuit

14 Blanking processing circuit

15 Clamping process circuit

16 Analog signal processing circuit

17 A/D converter

18 Digital signal processing circuit

19 D/A converter

[Translation done.]

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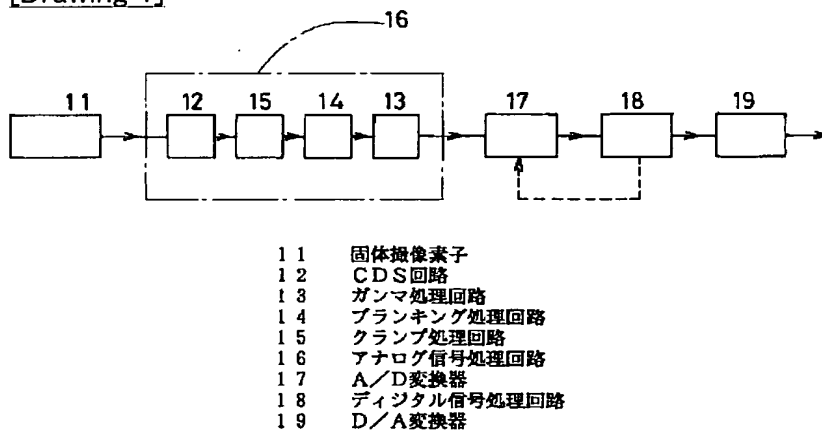
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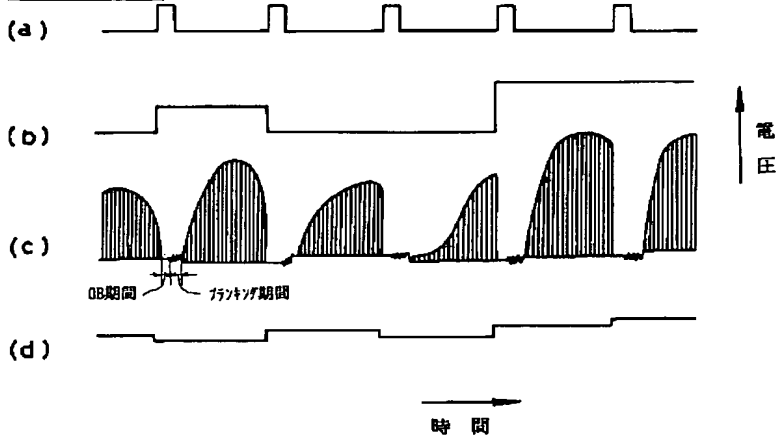
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DRAWINGS

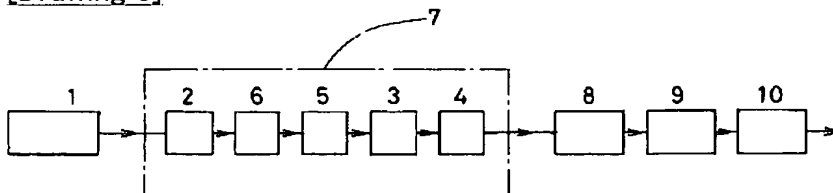
[Drawing 1]



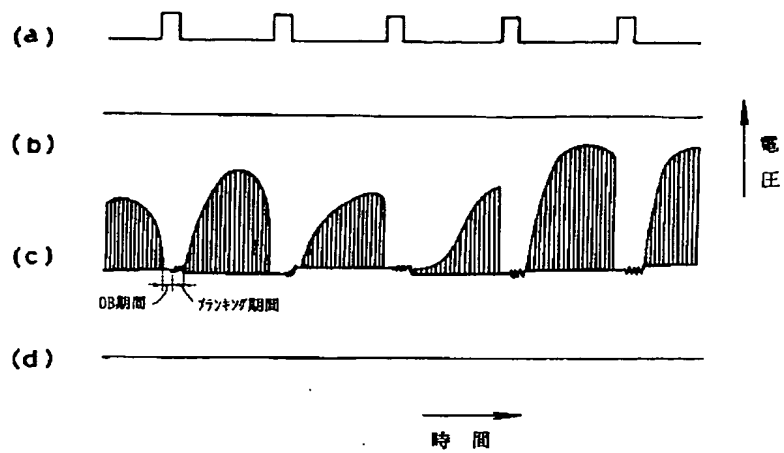
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-181886

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(51) Int. Cl.⁵

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H 0 4 N 5/20

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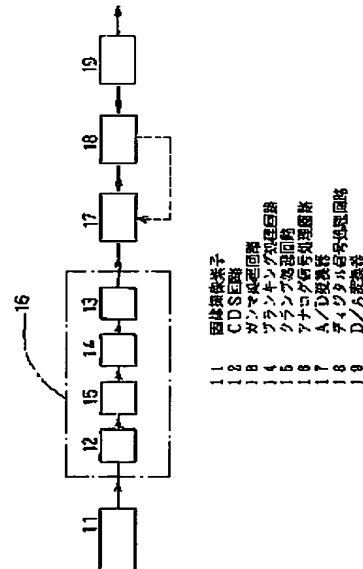
(54) 【発明の名称】 カメラシステム

(57) 【要約】

【目的】 アナログ信号処理回路を少なくして低価格化、小型化を実現する。

【構成】 固体撮像素子11の出力信号をアナログ処理するアナログ信号処理回路16の出力信号の高圧振幅を、固体撮像素子11の出力信号をデジタル信号に変換するA/D変換器17の出力信号を処理するデジタル信号処理回路18で検出し、その検出結果に基づき、固体撮像素子11の出力信号の高圧振幅に比例するように、A/D変換器17のA/D変換用上側基準電圧およびA/D変換用下側基準電圧を変化させる。

【効果】 A/D変換器17に入力される信号のレベルに合わせてA/D変換の基準電圧が変化するので、A/D変換前にアナログ信号処理でゲイン調整する必要がなくなり、回路の簡素化を図ることが可能となる。



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【特許請求の範囲】

【請求項 1】 固体撮像素子と、この固体撮像素子から出力されるアナログ信号をデジタル信号に変換する A/D 変換器と、前記 A/D 変換器の A/D 変換用上側基準電圧を前記固体撮像素子から出力されるアナログ信号の電圧レベルに応じて制御する A/D 変換基準電圧制御回路を備えたカメラシステム。

【請求項 2】 A/D 変換基準電圧制御回路が A/D 変換器の A/D 変換用下側基準電圧を固体撮像素子から出力されるアナログ信号の電圧レベルに応じて制御するようにした請求項 1 記載のカメラシステム。

【発明の詳細な説明】

【0001】

【産業上の利用分野】この発明は、ビデオカメラ等のデジタル信号処理（A/D 変換器）を利用したカメラシステムに関するものである。

【0002】

【従来の技術】近年、ビデオカメラや監視用カメラは、小型、軽量、高機能、低価格といったところに開発の主流が置かれており、信号処理のデジタル化が進んでいる。まず、図 3 に A/D 変換器を搭載した従来のデジタル信号処理ビデオカメラの構成を示す。このビデオカメラは、固体撮像素子（CCD）1 と、コリレーティッドダブルサンプリング（以下、CDS と略す）回路 2、オートゲインコントロール（以下、AGC と略す）回路 3、ガンマ補正処理回路 4、ブランキング処理回路 5 およびクランプ処理回路 6 を含むアナログ信号処理回路 7 と、A/D 変換器 8、デジタル信号処理回路（DSP）9、D/A 変換器 10 より構成されている。

【0003】図 4 に図 3 のビデオカメラの各部の電圧波形図を示す。図 4 の電圧波形図では、縦方向に電圧、横方向に時間をとっており、（a）は垂直同期信号、

（b）は A/D 変換用上側基準電圧 V_{refH} 、（c）は CDS、AGC、ブランキング処理、ガンマ補正処理等の固体撮像素子 1 の出力を前処理した後 A/D 変換信号、（d）は A/D 変換用下側基準電圧 V_{refL} を示している。

【0004】固体撮像素子 1 の出力信号はアナログ信号で、デジタル信号処理する前に A/D 変換する必要がある。A/D 変換器 8 には、A/D 変換用上側基準電圧 V_{refH} および A/D 変換用下側基準電圧 V_{refL} がそれぞれ入力され、両基準電圧 V_{refH} 、 V_{refL} の範囲に適合するように、A/D 変換器 8 に入力する変換対象の入力信号レベルが決定される。この場合、A/D 変換器 8 の入力信号レベルに適合するように AGC 回路（アナログ）3 で信号振幅が調整される。A/D 変換器 8 は、A/D 変換用上側基準電圧 V_{refH} および A/D 変換用下側基準電圧 V_{refL} の二つの基準電圧間を複数に分割し、各分割電圧と入力信号とを比較することにより A/D 変換される。

【0005】なお、A/D 変換する前に、固体撮像素子 1 独特のノイズ除去や黒レベル再生、テレビ出力用のガンマ補正処理など、デジタル信号処理に比べてアナログ信号処理の方がより効率よく実現できる部分はアナログ信号処理で行っている。このように、固体撮像素子 1 の出力信号に対して必要なアナログ信号処理を行った後、A/D 変換してデジタル信号処理回路 9 でデジタル信号処理を行う構成として、ビデオカメラの高機能・多機能化を進めている。

【0006】

【発明が解決しようとする課題】しかしながら、上記のような構成では、アナログ信号処理回路が多く、低価格化、小型化を実現できない。この発明は上記課題を解決するもので、アナログ信号処理回路を少なくして低価格化、小型化を実現できるカメラシステムを提供することを目的とする。

【0007】

【課題を解決するための手段】請求項 1 記載のカメラシステムは、固体撮像素子と、この固体撮像素子から出力されるアナログ信号をデジタル信号に変換する A/D 変換器と、前記 A/D 変換器の A/D 変換用上側基準電圧を前記固体撮像素子から出力されるアナログ信号の電圧レベルに応じて制御する A/D 変換基準電圧制御回路を備えている。

【0008】請求項 2 記載のカメラシステムは、請求項 1 記載のカメラシステムにおいて、A/D 変換基準電圧制御回路が A/D 変換器の A/D 変換用下側基準電圧を固体撮像素子から出力されるアナログ信号の電圧レベルに応じて制御するようにしている。

【0009】

【作用】この発明の構成によれば、A/D 変換器の A/D 変換用上側基準電圧と A/D 変換用下側基準電圧を固体撮像素子から出力されるアナログ信号電圧に応じて変更することで、A/D 変換器で AGC 機能を実現でき、従来のカメラシステムに必要であったアナログ信号処理の AGC 回路が省略可能である。

【0010】

【実施例】以下、この発明の一実施例のカメラシステムについて説明する。図 1 はこの発明の一実施例を示すもので、A/D 変換器を搭載するデジタル信号処理型のビデオカメラの構成を示している。このビデオカメラは、固体撮像素子 1 と、CDS 回路 12、ガンマ補正処理回路 13、ブランキング処理回路 14 およびクランプ処理回路 15 を含むアナログ信号処理回路 16 と、A/D 変換器 17 と、デジタル信号処理回路（DSP）18 と、D/A 変換器 19 より構成されている。

【0011】図 2 に図 1 のビデオカメラの各部の電圧波形図を示す。図 2 の電圧波形図では、縦方向に電圧、横方向に時間をとっており、（a）は垂直同期信号、

（b）は A/D 変換用上側基準電圧 V_{refH} 、（c）は C

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DS、AGC、ブラッキング処理、ガンマ補正処理等の固体撮像素子1の出力を前処理した被A/D変換信号、(d)はA/D変換用下側基準電圧 V_{refl} を示している。

【0012】固体撮像素子1の出力信号はアナログ信号で、デジタル信号処理する前にA/D変換する必要がある。A/D変換器17には、A/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} がそれぞれ入力され、両基準電圧 V_{refu} 、 V_{refl} の範囲に適合するように、A/D変換器17に入力する変換対象の19 入力信号レベルが決定される。この場合、A/D変換器17は、A/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} の二つの基準電圧間を複数に分割し、各分割電圧と入力信号とを比較することによりA/D変換を行い、変換出力信号をデジタル信号処理回路18に入力する。

【0013】このとき、デジタル信号処理回路18は、任意のデジタル信号処理(Y、C信号作成、C信号の同時化、オートホワイトバランス調整等)の他に、被A/D変換信号の1フィールド分の中での信号振幅の20 ピーク値を検出するとともに、最低レベル値を検出し、ピーク値および最低レベル値に基づいて、例えばアナログ信号の信号電圧の振幅に比例する状態に図2の

(b)、(d)のようにA/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} を変化させる。これにより、A/D変換器17に入力する信号のレベルに合わせてA/D変換器17のA/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} が21 変化するので、A/D変換前にアナログ信号処理でゲイン調整する必要がなくなり、従来必要であったAGC回路を省略できる。

【0014】この場合、図2から明らかなように、被A/D変換信号の1フィールド毎の信号電圧のピーク値に比例するようにA/D変換用上側基準電圧 V_{refu} が設定され、被A/D変換信号の1フィールド毎の信号電圧の最低レベル値に比例するようにA/D変換用下側基準電圧 V_{refl} が設定される。なお、図2において、A/D変換用上側基準電圧 V_{refu} が2フィールドにわたって同じ値であるのは、2つのフィールドで信号電圧のピーク値に22 変化がないからである。また、信号電圧の最低レベル値の変化は基本的にはCDS回路12で除去後クランプ処理回路15で一定になるのであるが、クランプ定数の設定(時定数を短くする)によっては、固体撮像素子(CCD)11のOB(オプティカルブラック)レベルのばらつきにより発生し、このOBレベルのばらつきを、A/D変換用下側基準電圧 V_{refl} を変化させることにより補償している。

【0015】また、A/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} は1フィールド前の信号電圧のピーク値および最低レベル値に従って設定23

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される。実際に、ビデオカメラで撮像する場合、図2のように、1フィールド毎に映像が変化することはほとんどなく、1フィールド前のピーク値のデータを基にA/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} を設定しても問題は生じない。映像に大きな変化があっても1フィールドで収束するため、画面上問題とはならない。

【0016】また、デジタル信号処理回路18の出力でA/D変換器17のA/D変換用上側基準電圧 V_{refu} およびA/D変換用下側基準電圧 V_{refl} を制御する構成の一例としては、デジタル信号処理回路18より映像信号とは別にAGC用のデータを作成し、このデータをデジタル信号処理回路18内でD/A変換してアナログ電圧を出力し、A/D変換器17へ供給することが考えられる。なお、D/A変換は、デジタル信号処理回路18とは別の集積回路で行ってもよく、またA/D変換器17に内蔵されたD/A変換器で行ってもよい。

【0017】この実施例では、図2のように毎フィールド基準電圧を変更しているが、検出の方法によっては、もっと早くても、もっと遅くても構わない。例えば、数ライン程度から数フィールド程度の範囲が考えられる。なお、検出の方法としては、例えば、ファクトリオートメーション(FA)等に使用するビデオカメラで画面全体の信号レベルが一様であるものを撮像する場合、画面上部の数ラインのみ信号を検出する(早くする)ことが24 ある。このときは、画面が一様であるので、検出は数ラインで十分である。また、遅くすることについては、数フィールドを考えているので、ビデオカメラ作りの上で普通に行われていることである。

【0018】また、この実施例では、図1のようにデジタル信号処理回路18からA/D変換器17の基準電圧の値をフィードバック制御しているが、アナログ信号処理回路16に信号電圧のピーク検出器を設けた場合、アナログ信号処理回路16等の他の回路からA/D変換器17の基準電圧の値を制御しても構わない。また、上記実施例では、A/D変換器17の基準電圧の値を制御するために、デジタル信号処理回路18でA/D変換器17の出力の信号電圧のピーク値を検出するように構成していたが、これに限らず、例えば信号電圧の上限および下限の平均値をそれぞれとり、ピーク検出時より大きな余裕をもって(例えば、検出値の3倍程度)基準電圧を決定することも考えられる。

【0019】なお、上記実施例では、A/D変換器8のA/D変換用下側基準電圧 V_{refl} は可変であったが、固定であってもよい。つまり、AGC機能だけであれば、A/D変換用上側基準電圧 V_{refu} を変化させるだけで十分であるが、上記の実施例では、AGCの精度を上げるために、A/D変換用下側基準電圧 V_{refl} も変化させて、オプティカルブラックレベルのばらつきに対する補償を行っているのである。25

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【0020】

【発明の効果】この発明のカメラシステムでは、A/D変換器のA/D変換用上側基準電圧とA/D変換用下側基準電圧をアナログ信号電圧の振幅に対して比例する状態に変更するようにしたので、A/D変換器でAGC機能を実現でき、従来のカメラシステムに必要なアナログ信号処理のAGC回路が省略可能であり、小型化、低価格化を図ることができる。したがって、その実用的効果はきわめて大である。

【図面の簡単な説明】

【図1】この発明の一実施例のビデオカメラの構成を示すブロック図である。

【図2】図1のビデオカメラの各部の電圧波形図である。

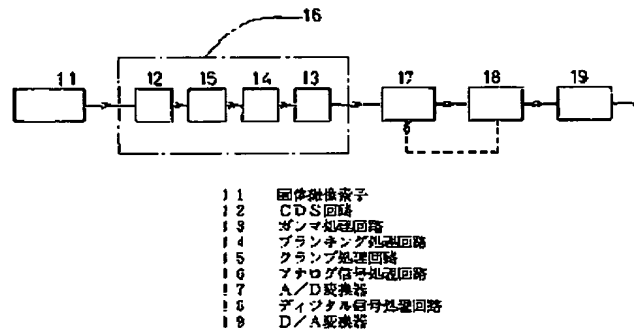
*【図3】従来のビデオカメラの一例の構成を示すブロック図である。

【図4】図3のビデオカメラの各部の電圧波形図である。

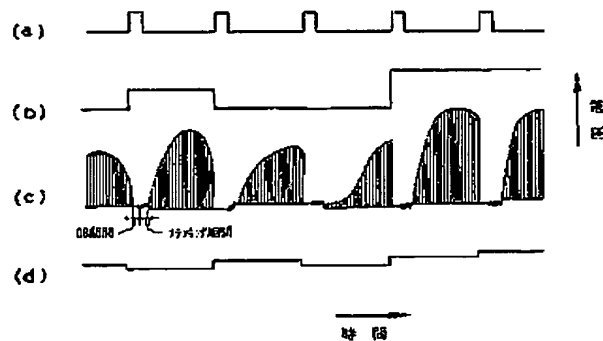
【符号の説明】

- 11 固体撮像素子
- 12 CDS回路
- 13 ガンマ補正処理回路
- 14 ブランキング処理回路
- 15 クランプ処理回路
- 16 アナログ信号処理回路
- 17 A/D変換器
- 18 デジタル信号処理回路
- 19 D/A変換器

【図1】



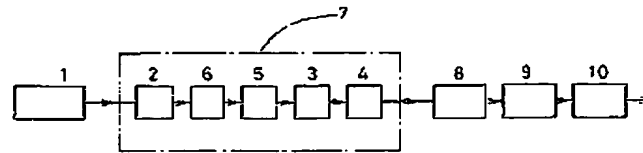
【図2】



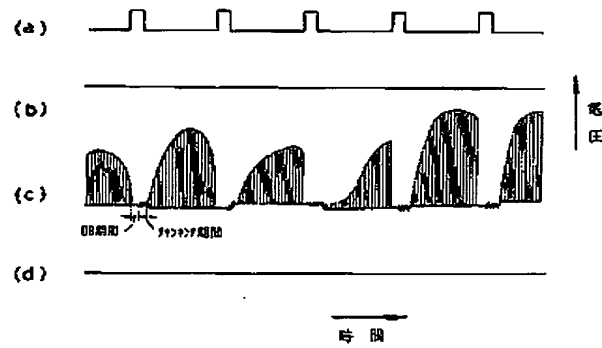
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【図 3】



【図 4】



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